



Technology and Development Capability Tested in the Global Arena

Takenaka Corporation is one of Japan's so-called super general contractors. With a history spanning more than 400 years since its foundation in 1610, Takenaka Corporation is safeguarding and improving building methods and technologies by cleaving to the traditional design-build contract method, but the company also responds to the requirements for sophistication and diversification in contemporary architecture by incorporating leading-edge technologies such as Building Information Modeling (BIM). Takenaka Corporation is continuously working to give tangible form to its management philosophy, "Contribute to society by passing on the best works to future generations."

Since gaining a foothold when entering the U.S. market in 1960, Takenaka Corporation has expanded its overseas network to set up businesses in every part of the world, handling more than 1,500 projects in the European and Asian regions respectively. In addition to Japanese corporations aiming to expand overseas, public institutions and local corporations in many countries have commissioned Takenaka Corporation to handle a large number of projects including airports, high-rise office buildings, hotels, and fine art museums. The corporation has won acclaim for a wealth of experience and achievements as well as its technological strength and flexible support.

One of these overseas projects, the CapitaGreen¹ high-rise building in Singapore, has won two awards this year: the CTBUH² Best Tall Building Awards and the BCA³ BIM Awards 2015 (Project Category) Platinum. In November, the building also won an award for excellence in the category Best Office & Business Development at the MIPIM⁴ Asia Awards 2015, suggesting that the project is also acclaimed from the perspective of real estate value. We talk with two of the design architects involved in the CapitaGreen project to find out more about the international recognition of technical capability at Takenaka Corporation.



Hirotsugu Yamaguchi
Senior Design Director

Tsukasa Ishizawa
BIM Manager

Q: The CapitaGreen building in Singapore has won two awards. What is it about CapitaGreen that is valued so highly?

Hirotsugu Yamaguchi:

When we received the BCA BIM Awards, CapitaLand, who gave us the contract for the project, said that the decision to hire Takenaka Corporation is the reason for the success of the project. Our work is based on the design-build contract method. Takenaka Corporation was set up in 1899, but traces its foundation back to a carpenter who specialized in building shrines and temples 400 years ago. It is common for Japanese carpenters to take responsibility for a project from the design to the finishing touches. At Takenaka Corporation, we are still emulating this practice by passing down the criteria for the design-build contract method. I believe that the technologies accumulated in this way were extremely effective for implementing the basic design by Toyo Ito, who is a world renowned architect.

Tsukasa Ishizawa:

I think that one particular reason for the acclaim is that we were able to meet the expectations placed on a Japanese contractor in Singapore such as an extremely short construction period, building something that was new for Singapore, and introducing new value. Take the life span of the building as an example: the lifecycle for high-rise buildings in Singapore used to be very short, with some buildings dismantled twenty years after completion. In Japan, the general practice is to use a building for fifty years, or one hundred years, or even longer. Singapore is in the process of shifting to this environmentally sustainable mode. To make a convincing case, we carried out every last adjustment and certification, even experimenting when necessary, to identify what points to verify to ensure long-term use of the building. Our technologies and the three-dimensional design technique, BIM, were a good fit with the search for quality, and I think this is linked to the acclaim.



Q: Please tell us about the relationship between Takenaka Corporation and Singapore that led to CapitaGreen.

Yamaguchi:

Changi Airport Terminal 1, completed in 1981, was the starting point for our activities in Singapore. Getting that commission, bringing it to a successful conclusion, and being recognized for the work is the cornerstone of the relationship. We have handled many high-rise office buildings, commercial facilities and hotels since then. Another factor is that we were asked to design and build the plants and production facilities that Japanese corporations required when they started to transplant to Singapore. These two factors enabled Takenaka Corporation to build a solid foundation in Singapore. I think new prospects will open up now that we have been recognized in this way by CapitaLand, a major real estate company in Singapore, who gave us the commission. At present we have another detailed design and build contract for Changi Airport Terminal 4 working with the same design-build contract format as CapitaGreen.

With its frameless glass curtain walls and extensive planting, the exterior of CapitaGreen makes a big impression.

Photo Courtesy of CapitaLand Limited





Located 200 meters above sea level in the roof-top garden, the 45-meter-tall air-intake funnel is itself equivalent in height to an 11-story building.

Photo Courtesy of CapitaLand Limited

Q: Please tell us what was difficult because it was Singapore, and what was only possible because it was Singapore.

Yamaguchi:

In Singapore, the temperature variation is only six or seven degrees during the whole year, the wind load due to typhoons is only about one third of Japan, and there are no earthquake worries, so you can't help thinking that the structural design will be easy. But, on the other hand, steel frames are more than twice the price they are in Japan, so there are cost-related limitations on building methods that force you to build with concrete. From the viewpoint of design and productivity, we had to build a 250-meter-tall skyscraper with the same column dimensions of 1m x 1m from bottom to top and without the use of a steel frame facially. To solve this problem, we were faced with a number of challenges including our first experience of using high-strength concrete and a range of precast concrete (PC) components in Singapore. We also used fair-faced precast concrete, which is not common in Singapore, to give the building a fine textured finish and to emphasize the intensely felt Japanese beauty. The funnel (air intake) on the rooftop, a special feature of this building, uses the prevailing winds in Singapore to supply fresh air to every floor. Since temperature variations are small, we utilized an environment that is suited to growing plants to incorporate a green wall. We used a wall construction with a semi-double skin to improve thermal efficiency, and we placed plants behind the slitted glass walls to achieve a greening ratio of 55% for the surface walls. I think it is extremely rare to incorporate such a high ratio of green wall in a high-rise building. There are several roof terraces on the aboveground floors. At first glance, they seem to be external, but they create a space where inside and outside are connected, bringing the outside into the building. Such designs and structural devices are the outcome of our experiments with approaches to a sustainable society including finding out how close buildings can get to nature, and whether they can blend into the natural environment.

Q: On the one hand, buildings are required to perform better from both the environmental and functional perspectives; on the other hand, development and construction are required to be quicker and more efficient. How did you deal with this either-or situation when building CapitaGreen?

Yamaguchi:

In Japan, you cannot strike the first pile before the entire construction design is finished and the certification applications are completed, but in Singapore it is possible to apply for building permission at every stage, and you can get the certificate and start driving the piles as soon as you know the load at the level of sustaining the above-ground structure and the positions of the posts have been decided in the master plan. For the CapitaGreen project, we first designed the piles that support the pillars, and we were able to start driving the piles immediately after we had designed the pillars, so during the year it took to build the piles, we worked on the detailed design. In short, we could carry out the processes of design and building in parallel and were able to use the year efficiently based on in-house knowhow from the design-build method that I mentioned at the outset. This is how we were able to shorten the construction period. It was extremely quick: only three years from putting together the overall plan to handing over the building to the customer.

Since CapitaGreen is a leased building, the effective leased area and the leasable ratio are the most important factors. We came up with all sorts of ingenious ideas to increase the real leasable ratio, and we took each idea back to the customer. I think it was advantageous for the customer that we could do this as well while driving the piles. Our technology is directly connected to the customer's income, so we were able to go back to the customer with technologies that shortened the construction time, and technologies that increased their profits.

Ishizawa:

During the year of driving the piles, all stakeholders met for workshops several times a month. I think it was very important that we had this time to discuss how we wanted to improve the design and how to build it. The Building Information Modeling (BIM) technique played an important role in this process. In the past, we would build a model by putting together all the sketches of the building, the blueprints, and the specification sheets, but BIM integrates all this information enabling us to construct the building on the computer. This makes it easier to understand the building and to do quantitative analysis. If you change the tools, the customer's understanding also changes. Even the way you talk about the site, and the way you go about building it change.

CapitaGreen has three Sky Terrace gardens in addition to the roof-top Sky Forest. Lush greenery fills the 20-meter-tall atriums and is carefully tended to ensure the plants' long-term health.



Q: The award-winning CapitaGreen is a milestone. Please tell us about future prospects.

Ishizawa:

When we organized the BIM team for this project, we eventually formed an extremely young team. This is an industry where length of experience is emphasized, but we were convinced that integrating the technologies and sensibilities unique to young staff members would tie in with a move toward the future. When we thought about integrating the generations, we wanted to overcome the idea that someone can't do something because they are young, or that someone else can do something because they are a veteran. We are now reaping the results through this project, so I think this is something we have to continue in the future.

Yamaguchi:

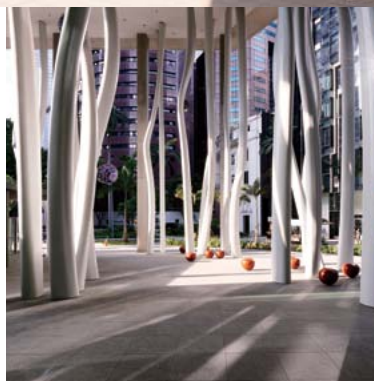
We are getting reactions to the news about these awards, and I am very pleased that the information is steadily dispersing to a higher dimension and pointing the way to new developments in the future. In addition, there was the world conference in Chicago in November where four international skyscrapers were presented and discussed. We can learn a lot from it. I think it is very important that we can participate and have dialogues among the various parties in such events because they are the driving force for the next step.

¹ A large-scale office building with forty above-ground floors constructed at Raffles Place in Singapore's financial district. The building features sophisticated energy-saving facilities, including a green wall that covers 55% of the façade.

² Council on Tall Buildings and Urban Habitat, an international organization headquartered at the Illinois Institute of Technology

³ Singapore Building and Construction Authority

⁴ The MIPIM ASIA Property Leaders Summit is held every November in Hong Kong. It mainly targets Asian investors.



Top: Artwork by Studio Olafur Eliasson.

Middle: Like a flowering tree reaching for the heavens.

Bottom: Infinity Pool in the private gym on the 38th floor.



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